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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/905,515	07/13/2001	Thomas Nowak	A4211/T33800	3320

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APPLIED MATERIALS, INC.
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EXAMINER	
MCDONALD, RODNEY GLENN	
ART UNIT	**PAPER NUMBER**
1753	6

DATE MAILED: 01/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/905,515	NOWAK ET AL.	
	Examin r	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with th correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *7-14,16-21 and 23-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *7-14,16-21 and 23-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *of 8-20-02* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 7, 11-14, 16-21 and 23-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shang et al. (EP 0 697 467) in view of Littau et al. (WO 99/02754).

Shang et al. a method for ***cleaning a deposition chamber*** used in fabricating electronic devices including the steps of ***delivering a precursor gas into a remote chamber that is outside the deposition chamber, activating the precursor gas in the remote chamber using a microwave generator to form a reactive species, flowing the reactive species from the remote chamber into the deposition chamber via conduit, and using the reactive species that is flowed into the***

deposition chamber from the remote chamber to clean the inside of the deposition chamber. (See Abstract)

In the case of a dry cleaning process, the remote excitation source breaks down the feed gas (e.g. a compound of chlorine or fluorine) to form a long lived halogen species. ***A second local excitation source may then optionally be used inside the chamber to sustain the long lived species and/or to further break down the gas to form the reactive species.*** Since the remote excitation source is relied upon to generate the reactive species, the local excitation source may be operated at much lower power levels than are required in a conventional system. (Column 2 lines 20-30) ***(Compare to forming of third plurality of radicals of Applicant's claim 18 and 20)***

Technically, the remote plasma is used to generate reactive species. To help solve the problem of quenching of the reactive species while it's flowing to the chamber ***a mild plasma may be applied in the process chamber to assist the cleaning. The use of the combined plasma sources achieves a better cleaning rate than would be associated with using either a local or remote plasma alone.*** (Column 3 lines 17-24)

Use of the local source to sustain the active species lessens the restrictions that might exist on the placement of the remote activation chamber. That is, the remote activation chamber can be placed conveniently, even at further distances from the deposition chamber, with less concern about quenching of the activated species as it is being transferred from the remote chamber to the deposition chamber. (Column 3 lines 40-49)

In accordance with the invention, a second gas supply system is connected to the chamber through inlet port 33. The second gas supply system supplies gas that is used to clean the inside of the chamber after a sequence of deposition runs. By cleaning, we mean removing deposited material from the interior surfaces of the chamber. (Column 5 lines 4-10)

The second gas supply system includes a source of a precursor gas 44, a remote activation chamber 46 which is located outside and at a distance from the deposition chamber, a power source 48 for activating the precursor gas within the remote activation chamber, an electronically operated valve and flow control mechanism 50, and a stainless steel conduit or pipe 57 connecting the remote chamber to the deposition chamber. (Column 5 lines 11-18)

Optionally, there may also be a source of ***a minor carrier gas 52*** that is connected to the remote activation chamber through another valve and flow control mechanism 53. The minor carrier gas aids in the transport of the activated species to the deposition chamber. ***It can be any appropriate nonreactive gas that is compatible with the particular cleaning proves with which it is being used.*** For example, ***the minor carrier gas may be argon***, nitrogen, helium, ***hydrogen or oxygen***, etc. In addition to aiding in the transport of activated species to the deposition chamber, ***the carrier gas may also assist in the cleaning process or help initiate and/or stabilize the plasma in the deposition chamber.*** (Column 5 lines 30-42) ***(Compare to a second precursor that is introduced in the chamber for cleaning as in Claim 7. Compare to Applicant's claim 16. Compare to a first precursor gas of***

Applicant's claim 18 and 20. Compare to Applicant's claim 23. Compare to Applicant's claims 28 and 31.)

In general, ***the reactive gases may be*** selected from a wide range of options including the commonly used halogens and halogen compounds. For example, the reactive gas may be chlorine, ***fluorine or compounds thereof***, e.g. NF3, CF4, SF6, C2F6, CCl4, C2Cl6. Of course, the particular gas that is used depends on the deposited material which is being removed. (Column 6 lines 47-53) ***(Compare to Applicant's gases of Applicant's claims 11, 12,14,19. Compare to Applicant's claim 24, 25. Compare to Applicant's claim 28)***

Because of the use of a local plasma in conjunction with the remote plasma, the remote activation chamber can be placed farther away from the chamber. Thus, only tubing is needed to connected the two remote source to the local source. ***Some quenching of the activated species (i.e. deactivation of the activated species) may occur during the transfer.*** However, the local source compensates for any such quenching that may occur. In fact, some long lived activated species (e.g. F*) typically do not return to the ground sate when quenched but rather they transition to an intermediate state. Thus, the amount of energy that is required to reactivate the quenched species is much less than is required to activate the gas in the remote activation chamber. Consequently, the local activation source (e.g. plasma) need not be a higher energy source. (Column 6 lines 57-58; Column 7 lines 1-14) ***(Compare to introducing a first precursor gas and creating a first plurality of radicals which are introduced to the chamber and to a second portion of the radicals that are***

reassociated (i.e. quenched as discussed) which are also introduced to the chamber as in Applicant's claim 7. Compare to Applicant's second precursor gas of Applicant's claim 18 and 20. Compare to Applicant's claim 23. Compare to Applicant's claim 28)

It should also be noted that by placing the remote source at a distance from the deposition chamber, ***the short lived radicals*** that are produced during the activation process will be quenched more completely than ***the long lived radicals*** as ***both are transferred to the deposition chamber. Thus, the reactive gas that flows into the deposition chamber will contain primarily the long lived radicals that have survived the transfer.*** For example, if NF3 is the reactive gas, two radicals are produced in the remote activation chamber, namely, N* and F*. The nitrogen radical is short lived and the fluorine radical is long lived. The nitrogen radical will typically not survive a long transfer from the remote chamber to the deposition chamber; whereas, a large percentage of the fluorine radicals will survive. (Column 7 lines 15-29) ***(Compare to introducing a first precursor gas and creating a first plurality of radicals (i.e. long lived radicals as discussed) which are introduced to the chamber and to a second portion of the radicals (i.e. short lived radicals as discussed) that are reassociated (i.e. quenched as discussed) which are also introduced to the chamber as in Applicant's claim 7. Compare to Applicant's claim 23. Compare to Applicant's claim 28)***

Figure 1 shows a housing 10, a remote dissociator 46, 48, a gas delivery system 57 and a local dissociator 12, 38, 40. (See Figure 1) (Compare to Applicant's claim 21)

The differences between Shang et al. and the present claims are that introducing the second gas by bypassing the dissociator is not discussed, sputtering is not discussed, removing carbon based residue is not discussed, the controller is not discussed and the computer readable program is not discussed.

Littau et al. teach a method and apparatus for cleaning a chamber in a substrate processing system having less reactivity with the chamber walls and the components contained therein. The method includes mixing a diluent gas with a flow of radicals produced by a plasma remotely disposed with respect to the chamber. (See Abstract)

Referring to Figs. 3 and 4, during the plasma clean process, a grounding step 340 is performed in which the entire chamber 15 and the components therein are grounded to preclude ion bombardment of the same by preventing large electric fields form being present therein. At step 342, a plasma is formed in the applicator that includes a plurality of reactive radicals. Thereafter, at step 344, a flow is formed from the reactive radicals that move towards the chamber 15. At step 346 a flow of diluent gas is formed traveling ***from the diluent gas supply 326 (Compare to Applicant's third gas of claim 21) toward the mixing manifold 322. The flow of reactive radicals intermixes with the flow of diluent gas, anterior to the chamber 15, when traveling through the mixing manifold 322 to form a gas-radical mixture. At step 348 the gas-radical mixture flows into the chamber 15 to remove deposition***

residue. (Page 20 lines 5-15) ***(Compare to the second precursor bypassing the remote dissociator for cleaning as in Applicant's claim 7. Compare to Applicant's claim 26, 27)***

Typically, the diluent gas is an inert gas, such as ***argon (Ar).*** However, the diluent gas may be a reduction gas that will react with fluorine radicals in the chamber 15. (Page 21 lines 16-18) An example of a reduction diluent gas is H_2. (Page 21 line 21) ***(Compare to a second precursor for cleaning as in Applicant's claim 7.)***

Figure 1F illustrates a block diagram for ***control*** of a chamber including the ***system control software and computer program.*** (Page 11 lines 22-24) ***(Compare to Applicant's controller and memory in Claim 21)***

As to the sputtering effect the energy of the power sources would causes a sputtering of the ions. (See Figure 1 items 38 and 48)

As to the removal of carbon any gas can be selected depending on the material to be removed. (See Shang et al. Column 6 lines 47-56) (Compare to Applicant's claims 17, 29, 30 and 32)

The motivation for having the second gas bypass the dissociator, utilizing a controller and a computer readable program is that it allows for cleaning a chamber. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Shang et al. by having the second gas bypass the dissociator, utilizing a controller and a computer readable program as taught by Littau et al. because it allows for cleaning the chamber.

Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shang et al. in view of Littau et al. as applied to claims 7, 11-14, 16-21 and 23-33 above, and further in view of Shang et al. (U.S. 5,788,778).

The difference not yet discussed is the amount of disassociation.

Shang et al. '778 teach in Fig. 2 that the amount of activated gas can approach 100% depending on the RF power applied. (See Figure 2; Column 5 lines 38-53)

The motivation for controlling the amount of activated gas is that it allows for controlling plasma stability based on power. (Column 5 lines 66-68; Column 6 lines 1-2)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have controlled the amount of activated gas as taught by Shang et al. '778 because it allows for controlling plasma stability.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
January 6, 2004